Some of the statements contained in this presentation that are not historical facts are statements of future expectations and other forward-looking statements based on management’s current views and assumptions and involve known and unknown risks and uncertainties that could cause actual results, performance, or events to differ materially from those in such statements. Such forward-looking statements are subject to various risks and uncertainties, which may cause actual results and performance of the Company’s business to differ materially and adversely from the forward-looking statements.

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1. Key Industry Trends
2. Technology Organisation in SBM
3. Technology Advances
   - FPSO Technology
   - Mooring System Technology (A. Newport)
   - Semi Sub & TLP Technology (A. Newport)
   - FLNG Technology
   - Other Technology
4. SBM Group Technical Standards
5. Conclusions
Industry Trends
What We Are Hearing From Our Clients as Key Trends in the Industry

DEEPER

HARSHER

COLDER

OLDER

LARGER

CLEANER

SMARter

LOWER $
Key Industry Trends

- Deeper
- Harsher
- Colder
- Older
- Larger
- Cleaner
- Smarter
- Lower
Key Industry Trends

- Deeper Water – Beyond 3000m
  - Riser Technology
- Deeper Reservoirs – 10,000m and deeper
  - Ultra High Pressure/High Temperature
Key Industry Trends

- Harsher Conditions in Frontier Areas
- Permanently Moored in Cyclonic Regions
  - Larger mooring loads
Field developments moving further North into Arctic waters

- Disconnectable under ice loads
- Operability in severe ambient conditions
Key Industry Trends

- Improved seismic, drilling and EOR
- Facilities staying beyond original design life
- Asset integrity focus
- Material selection for longer life
Key Industry Trends

- Increased capacity, higher pressures and more complex processing
  - Larger topsides modules
  - Hull size, strength, stability
Key Industry Trends

Increasing demand for cleaner fuels such as LNG

- Floating LNG now becoming accepted
- Need to find lower cost FLNG solutions
Key Industry Trends

- Shortage of skilled manpower, while offshore facilities get more complex
  - Optimise balance between offshore and onshore workforce
Increasingly hard to sanction deepwater projects – Capex vs. oil price trends

- Urgent need to reduce cost & schedule
Industry Trends Mainly Working Against Cost Reduction Objective
Technology Development in SBM Offshore
Four Technology Leadership Centres

Monaco
Mooring Systems

Schiedam
Gas, Hulls

Houston
Semis, TLP’s, Risers

KL
Topsides
<table>
<thead>
<tr>
<th>Status</th>
<th>TRL</th>
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</thead>
<tbody>
<tr>
<td>Proven in service for &gt;3 years</td>
<td>7</td>
</tr>
<tr>
<td>System installed and operating.</td>
<td>6</td>
</tr>
<tr>
<td>Execution of full scale project</td>
<td>5</td>
</tr>
<tr>
<td>System prototype / FEED</td>
<td>4</td>
</tr>
<tr>
<td>Component prototype / pre-FEED</td>
<td>3</td>
</tr>
<tr>
<td>Concept validation by testing</td>
<td>2</td>
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<tr>
<td>Concept proving by theory</td>
<td>1</td>
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<tr>
<td>Idea definition</td>
<td>0</td>
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</tbody>
</table>

Technology developed in SBM is now matured through a stage-gate process to ensure robustness prior to first sale.
FPSO Technology
Generation 1
Simple Oil Processing FPSOs

**FPSO IV** 1986 to 1998

**FPSO II** 1981 to 1996

**Rang Dong I** 1998 to 2008
Marlim Sul

FPSO Brasil

Generation 2
FPSO Brasil and Marlim Sul
Generation 2
FPSO Brasil & Marlim Sul

Power generation

Slop Tanks

Oil Storage (Cargo Tanks)

Main Compression

Gas Dehydration

Booster Compression

Oil / Gas / Water Separation

Oil Stabilization & Dehydration

Water Injection Pumps

Seawater Deaeration

Seawater Sulfate Removal

Wells

Gas Lift

Gas Export

Water Injection

Turret / Manifold

Utilities

Vessel
Generation 3

Cidade de Paraty and Beyond…

- Cidade de Ilhabela 2014
- Cidade de Saquarema 2015
- Cidade de Maricá 2016
Generation 3
*Cidade de Paraty and Beyond*

Diagram showing the processes involved in oil and gas operations, including CO₂ Injection, CO₂ Compression, Lift/Export Compression, H₂S Scavenger, Gas (Deep) Dehydration (Mol Sieves), Gas Dewpointing, and Gas Separation (Membranes) among others.
Generation 3 FPSO’s Measure of Complexity

**Topsides Weight (mt)**

- G1: 1,000
- G2: 10,000
- G3: 23,000

**Shaft Power (MW)**

- G1: 10
- G2: 100
- G3: 225
Cidade de Ilhabela – Sailaway
Process Intensification (PI)

**Subject**
- Compact topsides technologies

**Objective**
- Process Intensification:
  - Reduce topsides weight
  - Increase capacity
  - Reduce HC inventories
  - Reduce fabric maintenance

**Value Proposition**
- Greater capacity
- Cost reduction
- Improved & Inherent Safety
- Improved Performance
New Technology with PI Ultrafiltration of Seawater

C.de Ilhabela sea water treatment:
- MMF ➔ vac DA ➔ SRP
- 180,000 bwpd

Standardised, scalable SW treatment:
- UF ➔ SRP ➔ vac DA
- 270,000 bwpd

Note: Pictures to approx. same scale
New Ways of Working Offshore

Full data transmission to shore

Onshore Support Center (OSC)

Real Time Support to Crew

More plant automation

Lower maintenance equipment

Improved offshore manning

Optimized offshore manning

Improved performance

Offshore

Onshore
Turret Moored FPSO
Current Range of Internal Turrets

Petrobras P-53
Shell Espirito Santo
BP Skarv
Petrobras Marlim Sul
Shell Prelude
BP Quad 204
Virtually no limit on riser number – scalable

Virtually no limit on mooring loads

Bogies and radial wheels are inspectable and replaceable
Top Mounted Internal Turret (TMIT)

- Bogies support axial loads
- Radial wheels support radial loads
- Dry access in turret for inspection and maintenance
- The bogie design is standard
- The number of bogies is selected to accommodate the design loads (N+1)
Espírito Santo employs steel lazy wave risers

Steel Lazy Wave Risers terminate at lower cylinder deck

Umbilicals terminate at upper cylinder deck

Weathervaning system unaffected
- Disconnectable FPSO in 2,900 meters
- Steel lazy wave risers
- Worlds deepest production unit
Turritella Mooring System
Disconnectable Mooring Systems

Able to disconnect under loads (600 tons per locking device)

Able to transfer up to 900 tons per locking device when connected
A slender buoy (spar) decoupled from the FPSO heave motions

Capable of supporting much larger number of steel risers

Disconnectable for hurricane events
Icebergs
- 100 yr return condition
- Disconnect under low loads

Ice fields
- Ice vaning
- Disconnect under high loads
Key Mooring Challenges

- Sheet ice – “Ice Vaning” required
- Mooring system disconnectable under ice loads
Ice Vaning Tests in Arctic Model Test Basin

Ice model test campaign in Arctic conditions
Articulated Rod Connecting Arm (ARCA)

- Improved Maintenance
- Diverless – Safer
- Cost Reduction
Swivels transfer fluids, utilities, power and signals between the geostationary turret and the weathervaning vessel.
Growing in Size of Swivel Stacks
Very High Pressure Swivels
Introduced in 2014
Core Swivel Technology

SBM’s Carros Laboratory
HVAC swivel rated at 65 kV and 150 MW
### Mooring Systems – Summary

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deeper</td>
<td>VPH Swivels for deeper reservoirs</td>
</tr>
<tr>
<td>Harsher</td>
<td>Increased mooring loads using bogie bearings</td>
</tr>
<tr>
<td>Colder</td>
<td>Disconnectable turrets for Arctic</td>
</tr>
<tr>
<td>Larger</td>
<td>Higher capacity swivels, optimised manifolds</td>
</tr>
<tr>
<td>Lower Cost</td>
<td>ARCA, higher capacity external turrets</td>
</tr>
</tbody>
</table>
Proven Deepwater Semi-Submersibles and Tension Leg Platforms

**Beyond ~1500m water depth**
DeepDraft Semi Submersible
- 2 Units installed in US GoM
- Operating in 2450m water depth
- Optimised for wet trees and steel risers
- Also available for dry trees in moderate Hs

**Below ~1500m water depth**
Tension Leg Platform (TLP)
- 5 SeaStar units installed, marginal field solution
- FourStar TLP design for larger fields
- Both available for dry or wet trees
Production units in areas of developed infrastructure do not need storage
Builds on SeaStar experience

Higher payload than SeaStar

Suitable for Wet or Dry Trees

Topsides integrated at Quayside

FourStar™ TLP
Drilling Riser TRIP-SAVER™

Allows all wells to be drilled consecutively without recovering and redeploying the Drilling Riser

Significant Drillex saving
Horizontal Tendon Assembly
Horizontal Tendon Assembly

Significant Installation saving
SBM Deep Draft Semi™ with Dry Trees

- Builds on production semi experience
- Lower cost and more flexible than a Spar
- Quayside topsides integration
- Beyond 1500 m, more cost effective than a TLP
FLNG Technology
• 2/3 of global FPSO fleet are based on tanker conversions
• Conversions dominate in small to mid-scale FPSO oil capacity
FLNG vessels based on LNG tanker conversions can replicate the success of converted FPSOs, drawing on experience from the global FPSO fleet.
Mid Scale Floating LNG

FLNG Twin Hull Concept

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Topsides Process Selection

\[ NPV = fn \text{ (Capex, Opex, Efficiency, Uptime, Risk)} \]
<table>
<thead>
<tr>
<th></th>
<th>Dual Mixed Refrigerant</th>
<th>Single Mixed Refrigerant</th>
<th>Dual Nitrogen Expansion</th>
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<tbody>
<tr>
<td>Proven technology</td>
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<td>Yes</td>
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<tr>
<td>Overall space required</td>
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<td>High/Moderate</td>
<td>Moderate</td>
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<tr>
<td>Hazardous Refrigerant</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
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<tr>
<td>HC Refrigerant make-up</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
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<tr>
<td>Explosion Hazards</td>
<td>High</td>
<td>High</td>
<td>Low</td>
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<tr>
<td>Complexity of operation</td>
<td>High</td>
<td>Moderate</td>
<td>Low</td>
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<tr>
<td>Process Efficiency</td>
<td>High</td>
<td>Moderate</td>
<td>Moderate</td>
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<tr>
<td>Expected Availability</td>
<td>Moderate</td>
<td>Moderate</td>
<td>High</td>
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<tr>
<td>Total Capital Cost</td>
<td>High</td>
<td>High/Moderate</td>
<td>Moderate</td>
</tr>
<tr>
<td>Operating Cost</td>
<td>High</td>
<td>High</td>
<td>Moderate</td>
</tr>
</tbody>
</table>
1/60 Scale Model Test in MARIN Basin

- 6 Motion sensors
- 1 Splitting force measurement frame
- 4 Green water pressure sensors
- 8 Wave proves for water on deck
- 8 Wave height sensors
- 5 Slamming sensors
- Camera
Comparison Between Converted FPSO and Converted FLNG

- Similar Topsides weight
- Similar Capex
- Similar Schedule
Competitive Advantage Through Technology – Twin Hull FLNG

- Lower CAPEX
- Faster Delivery
- Better Inherent Safety
- Excellent Performance
- Strong Partners
- Local Content Opportunity
Other Technology
30,000 bpd + 40 MMscfd → 33,000 bpd blended crude

Extended Well Test with GTL
Heavy Oil Upgrading

FPUSO Main Components

50,000 bpd of 9° API → 45,000 bpd 20° API
S3 Wave Energy Converter (WEC)

Electro Active Polymer (artificial muscle) converts mechanical energy into electrical energy

No mechanical moving parts, Excellent Efficiency
Continuous Feedback Loop

- **ENGINEERING**
- **PROCUREMENT**
- **RELOCATION**
- **CONSTRUCTION**
- **OPERATIONS**
- **INSTALLATION**
### Technical Lessons Learnt

<table>
<thead>
<tr>
<th>CLIENT:</th>
<th>SBM OPERATIONS</th>
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<tbody>
<tr>
<td>PROJECT:</td>
<td>GROUP TECHNICAL STANDARDS</td>
</tr>
<tr>
<td>DOCUMENT TITLE:</td>
<td>MECHANICAL</td>
</tr>
<tr>
<td></td>
<td>UNFIRED PRESSURE VESSEL</td>
</tr>
<tr>
<td></td>
<td>STANDARD SPECIFICATION</td>
</tr>
</tbody>
</table>
| ES45000             | PECEMETS999005                  | A 3
- Established 2003
- 150 Standards and Specifications
- Pre Approved by ABS
- Updated annually
- Default standards for SBM leased FPSOs
- Now also applied to 4 EPC Sale FPSOs
Conclusions
SBM Technology – Conclusions

Exciting Portfolio of new Products and components

Aligned to needs of clients and Industry Trends

Strong Technical Partners

Major Cost & Schedule reduction initiative

Stage Gate process for TRL